

Figures

Figure 1. Annual sampling frames and quarter-quadrangle sampling plots with primary and oversample plots.

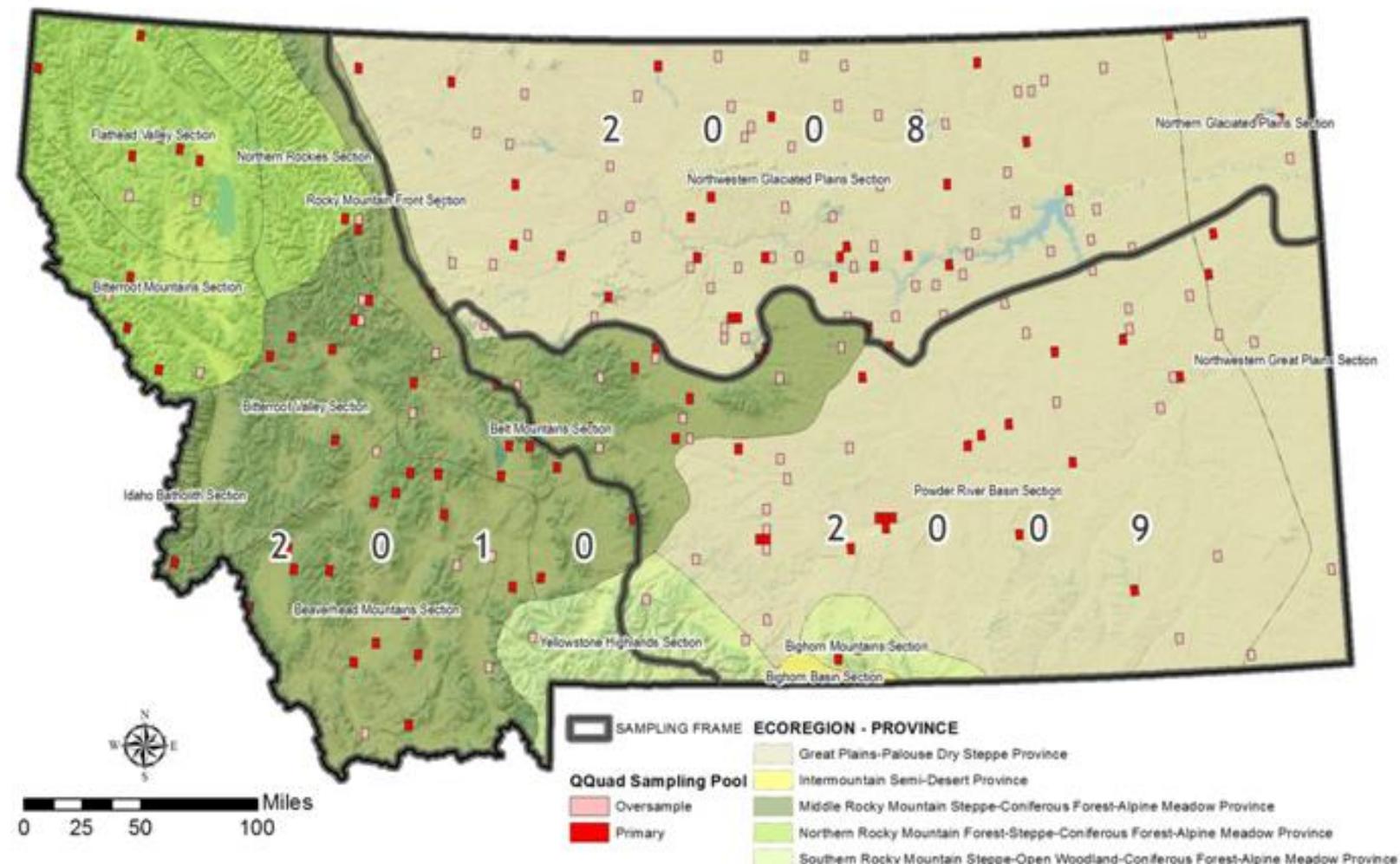


Figure 2. Land ownership patterns and example quarter-quadrangle maps used for field sampling, showing various land cover types represented in a particular sample unit. Specific locations for trap placement or surveys were selected based on fauna group and habitat, e.g. one small mammal survey per quarter-quadrangle had to be placed in a riparian area.

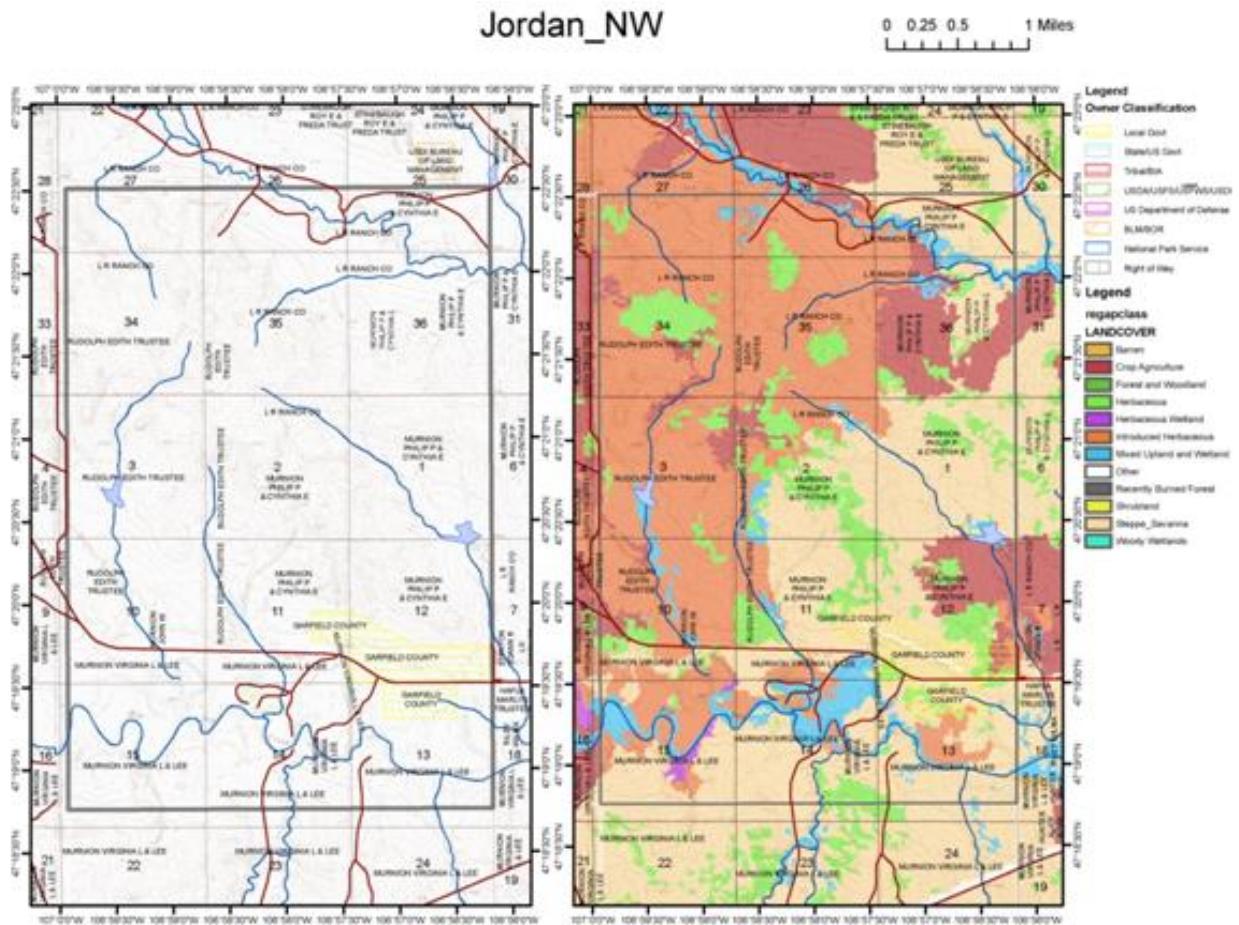


Figure 3. Example of sampling timeline for one quarter-quadrangle.

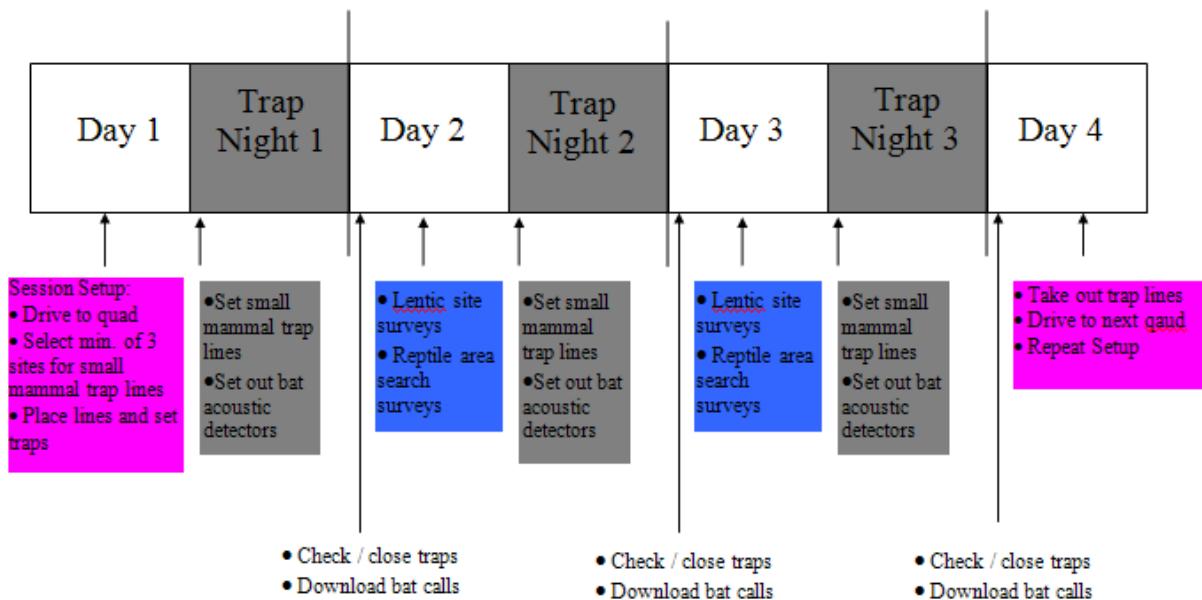


Figure 4. Sample quarter-quadrangle showing example locations of bat acoustic, lentic amphibian and aquatic reptile, terrestrial reptile, and small mammal trap line sites within a 3 x 4.3 mile quarter-quadrangle area.

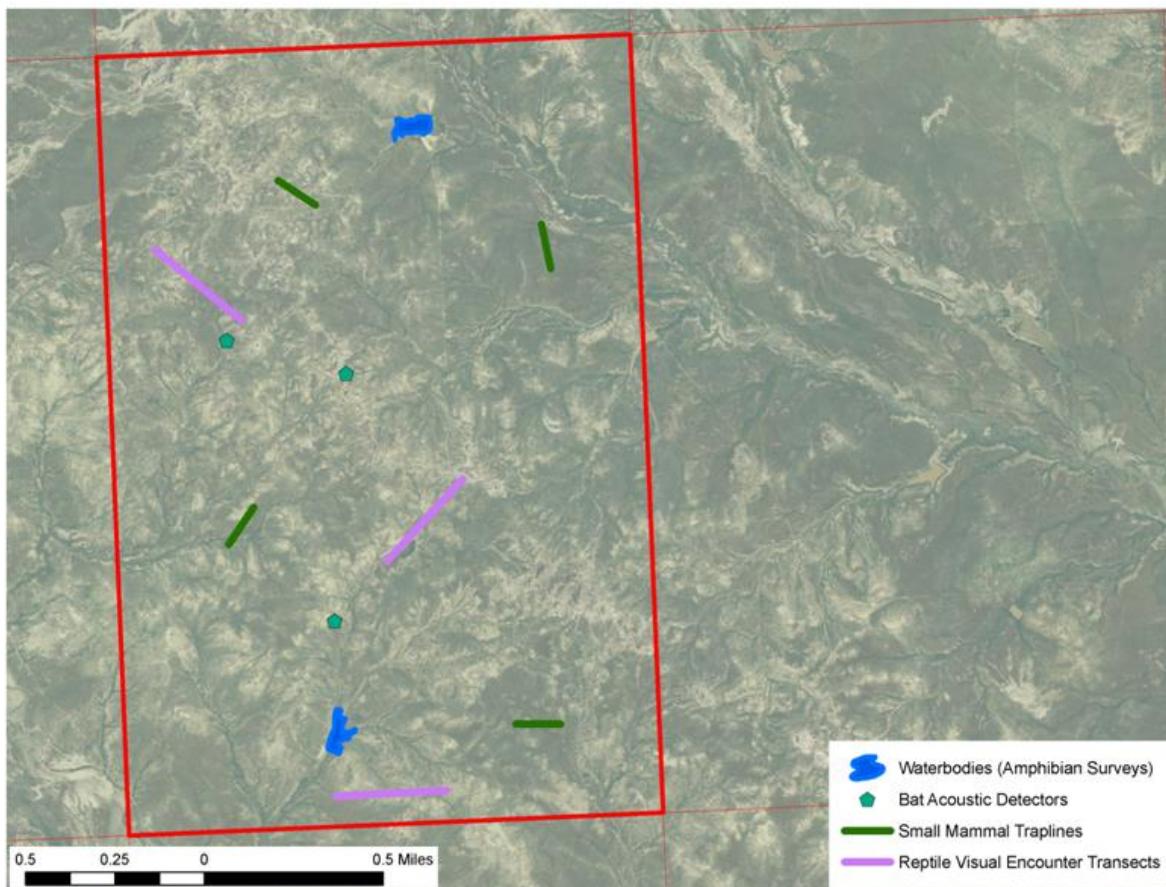


Figure 5. Small mammal trap line demonstrating different trap types on each line.

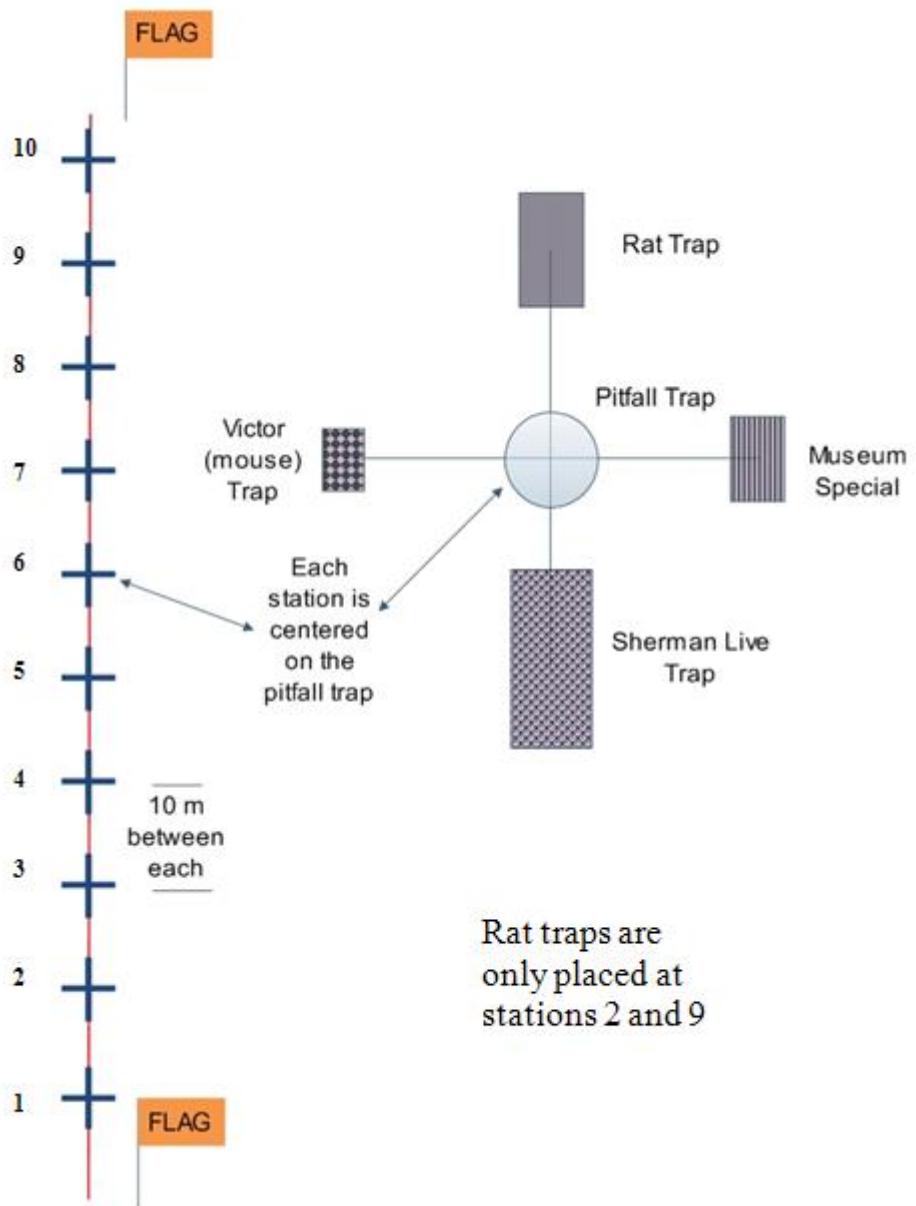


Figure 6. Small mammal trap line in eastern Montana showing the orientation of a pitfall and Sherman live trap.



Figure 7. Bat acoustic detector housed inside a weather protective enclosure.



Figure 8. Lentic site in eastern Montana with significant emergent vegetation that required dip netting and transect surveys for amphibians and aquatic reptiles.



Figure 9. Reptile survey site with high topographic relief in eastern Montana.



Figure 10. Entity relationship diagram of the database tables used to store information collected during structured surveys of the Diversity Monitoring Project. Lookup tables with covariate attributes and options are not shown for the sake of brevity.

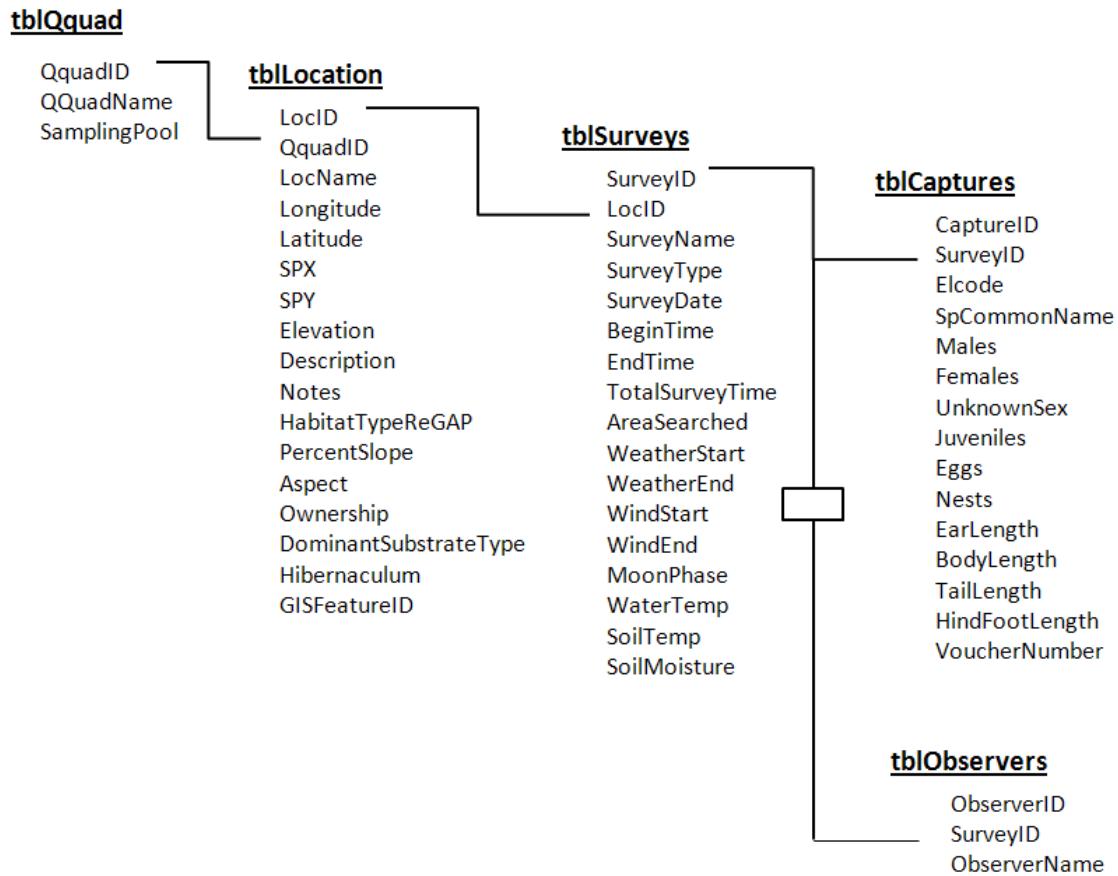


Figure 11a. Locations of small mammal trap line surveys, the number of unique species captured at each quarter-quadrangle, and the total number of each species captured within a quarter-quadrangle for the duration of the sampling period. Example: the large circle in southwest Montana with the number 23 inside it represents a survey where 23 individuals of 12-15 different species were detected. The number '3's in eastern Montana represent survey sites where 3 individuals of 1-2 species were detected.

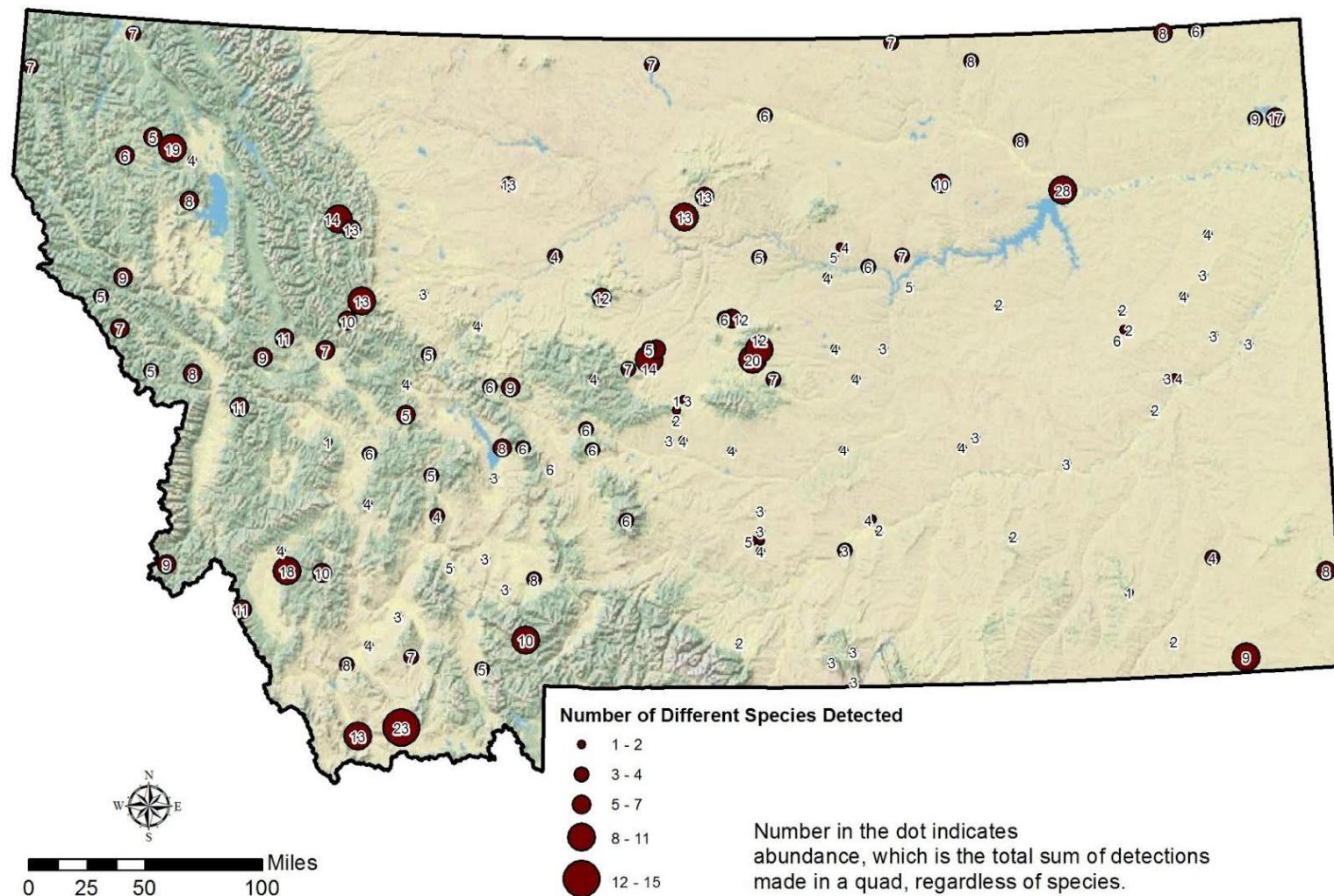


Figure 11b. Locations of bat acoustic surveys and the number of unique species detected at each quarter-quadrangle and the total number of each species detected within a quarter-quadrangle for the duration of the sampling period. Example: the large circle in northeast Montana with the number 7 inside it represents a survey where at least 7 individuals of 7-9 different species were detected.

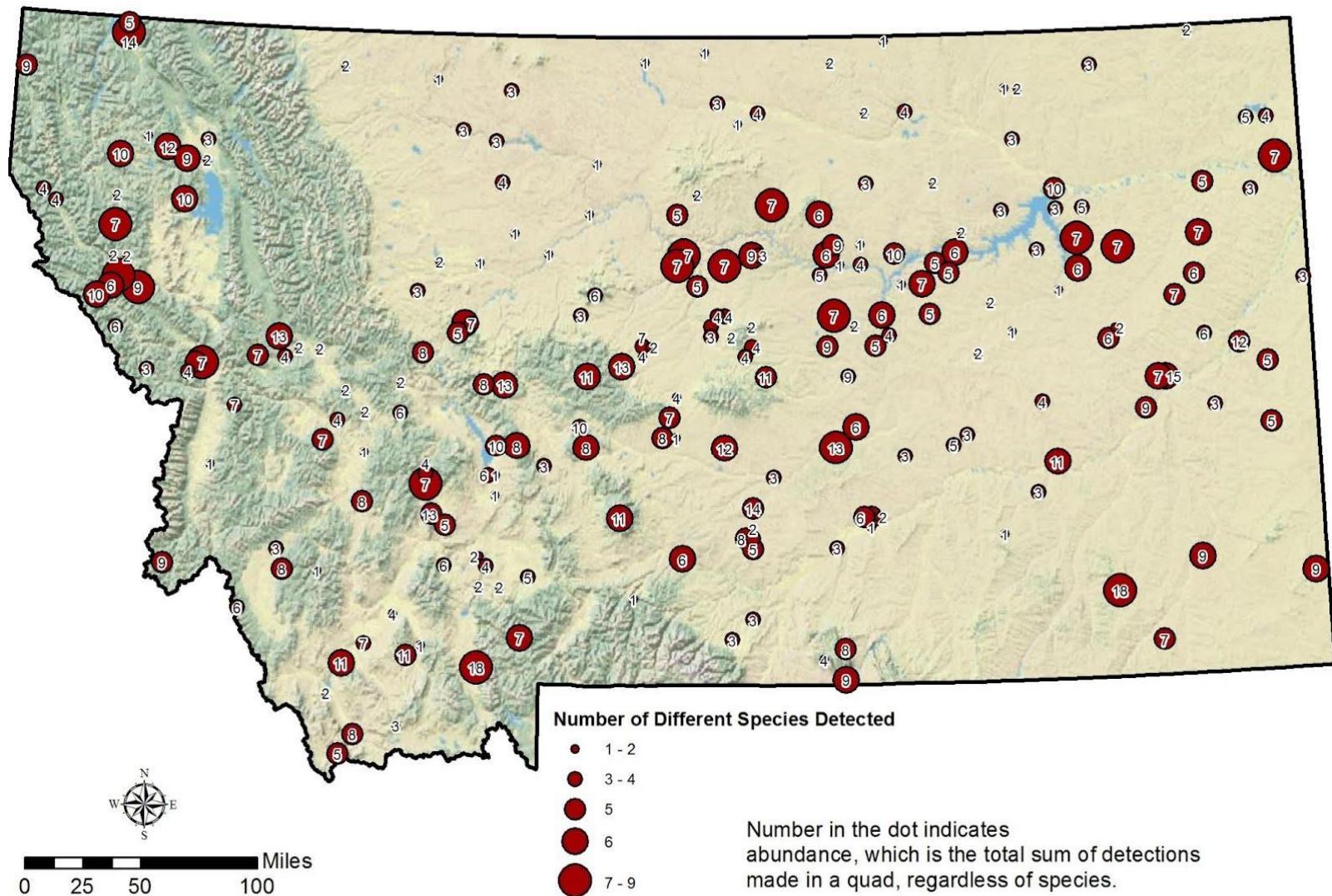


Figure 11c. Locations of lentic site surveys and the number of unique amphibian and aquatic reptile species detected at each quarter-quadrangle and the total number of each species detected within a quarter-quadrangle for the duration of the sampling period. Example: the large circle in northeast Montana with the number 8 inside it represents a survey where 8 individuals of 6-7 different species were detected.

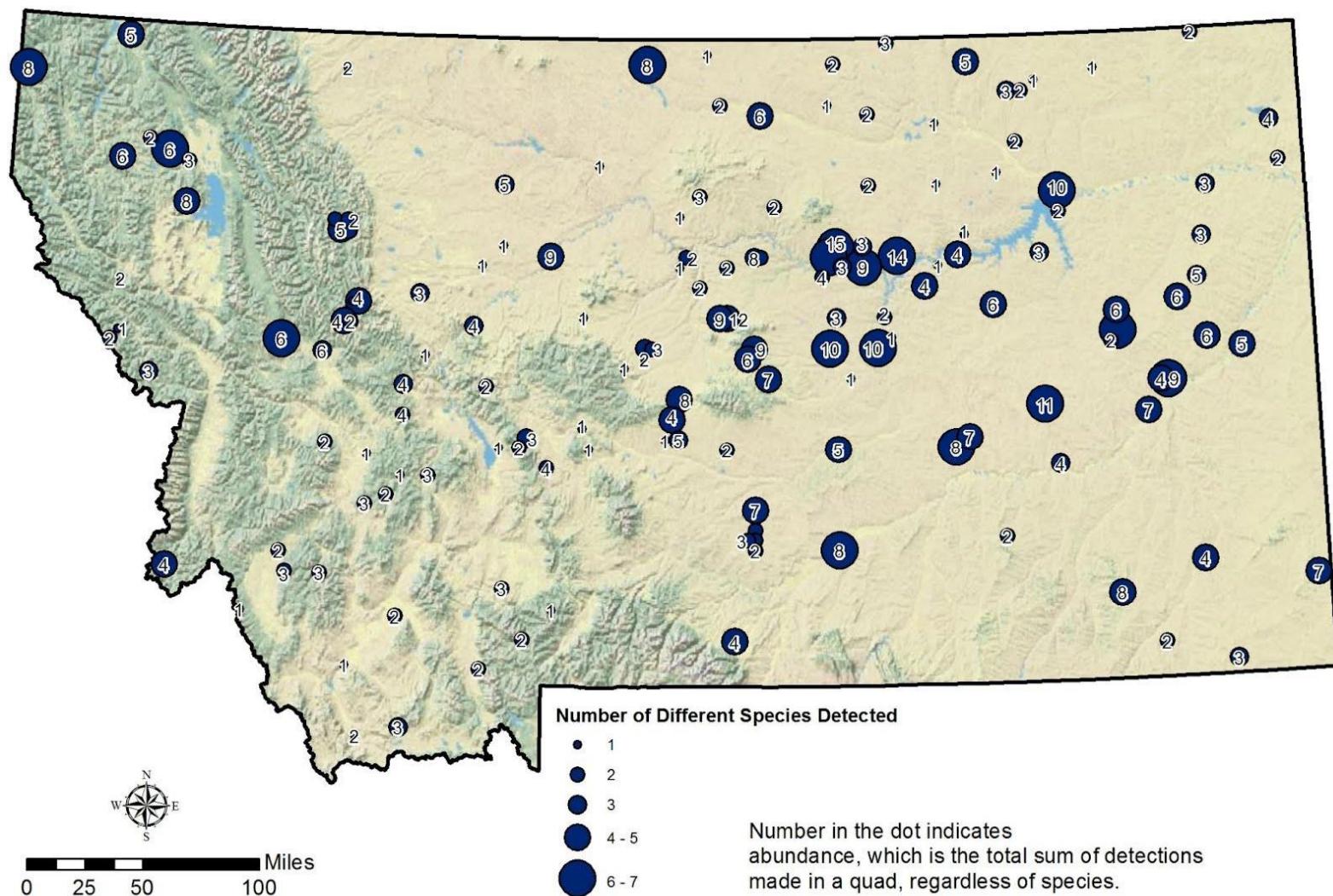
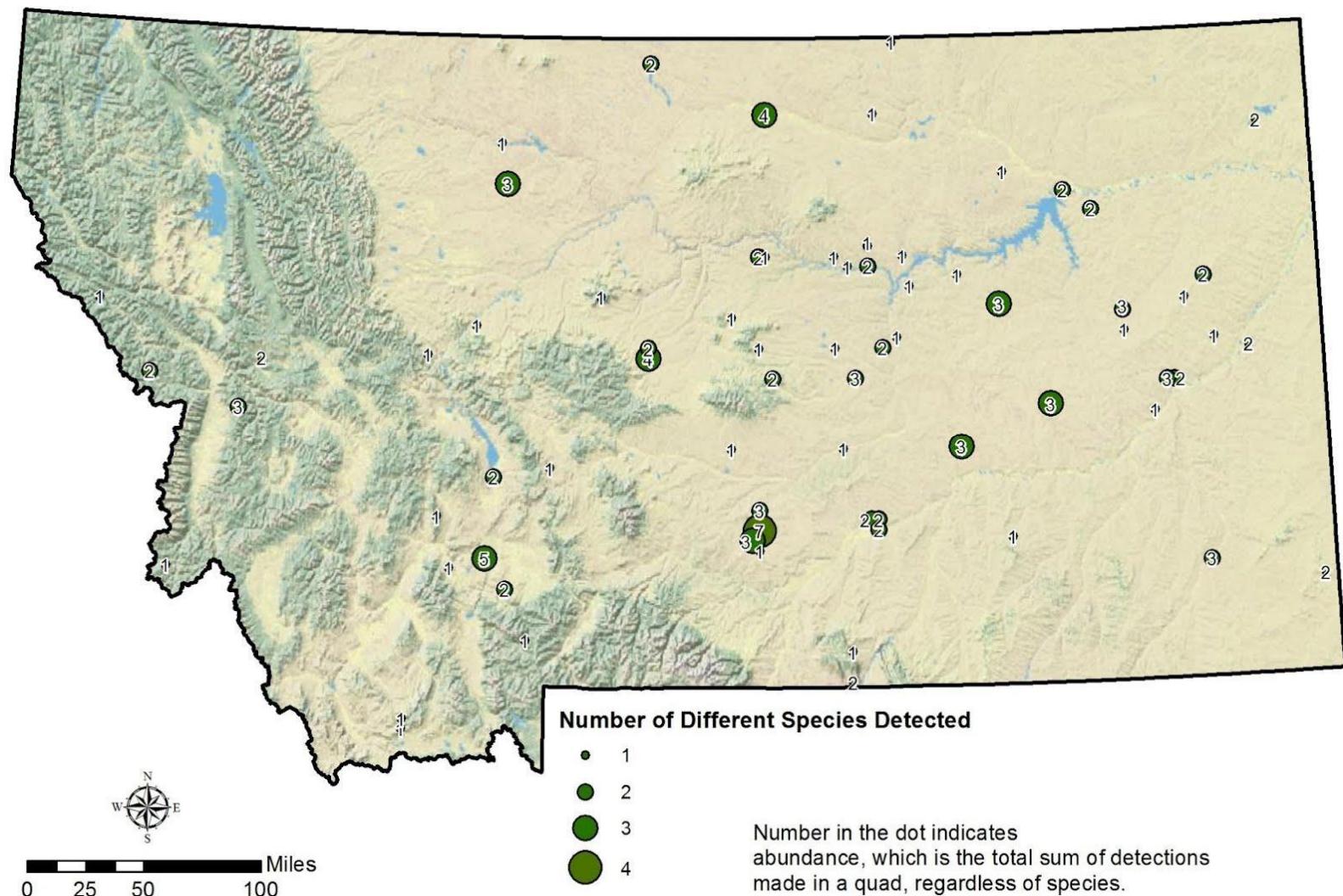


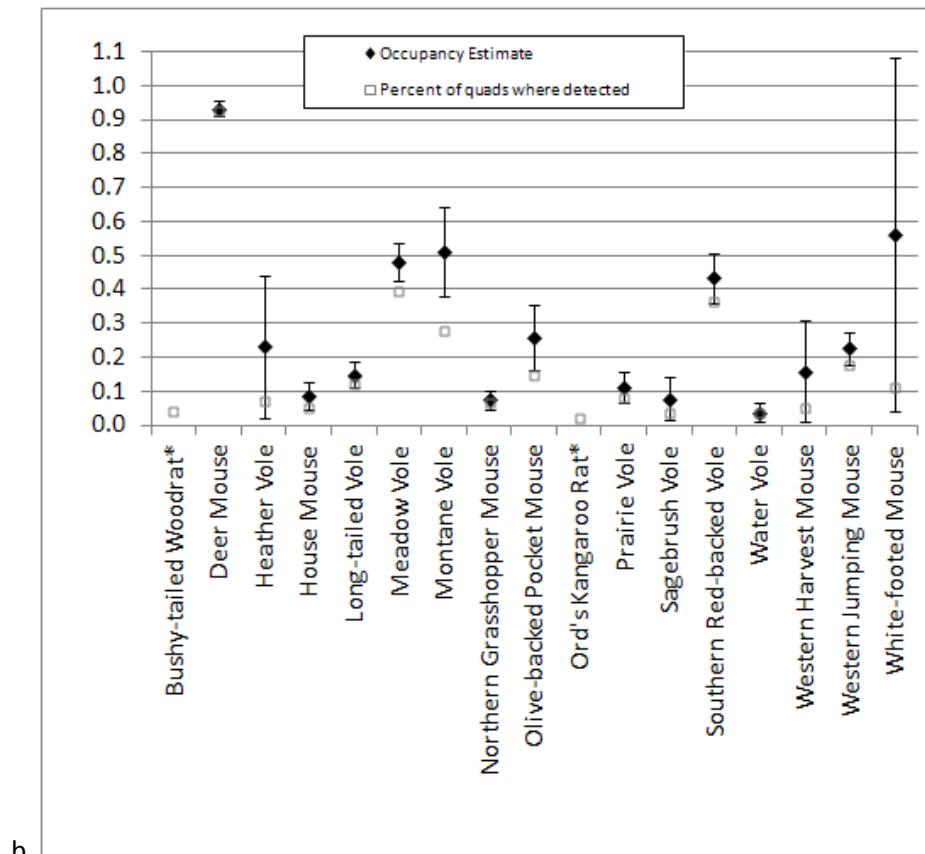
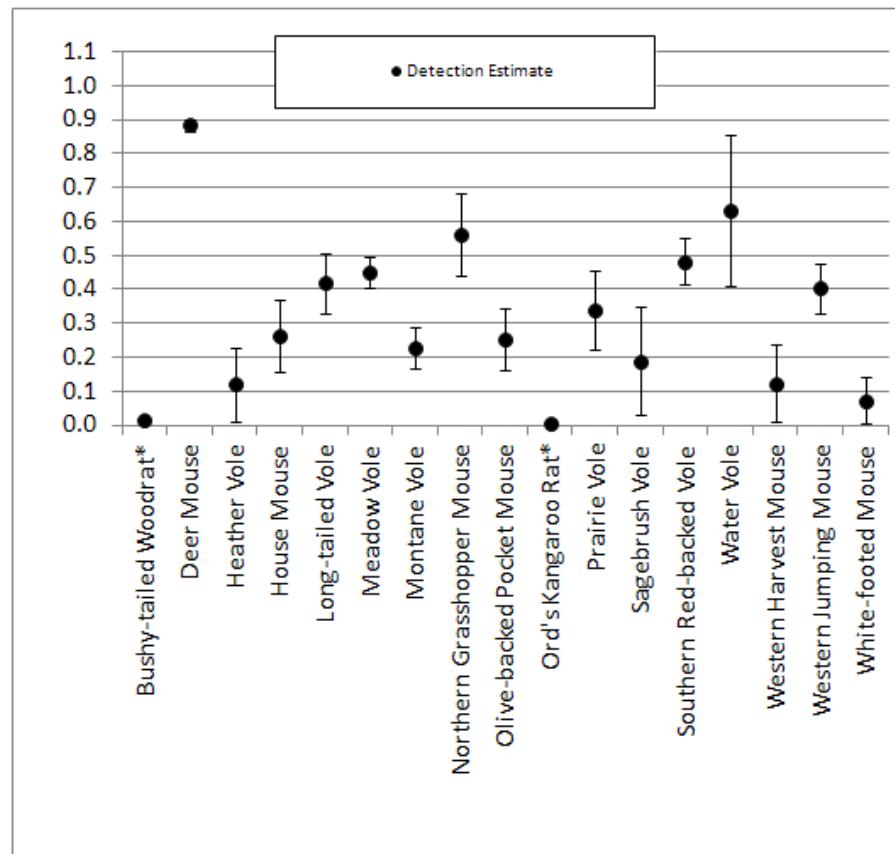
Figure 11d. Locations of reptile surveys and the number of unique species detected at each quarter-quadrangle and the total number of each species detected within a quarter-quadrangle for the duration of the sampling period. Example: the large circle in north central Montana with the number 4 inside it represents a survey where 4 individuals of 3 different species were detected.



Detection and occupancy estimates from small mammal capture surveys for Muridae, Heteromyidae and Dipodidae.

Figure 12a. Point estimates and 95% CI of detection probability (p) estimates. Asterisks represent species where too few repeat detections precluded an estimate of detection and/or occupancy.

Figure 12b. Point estimates and 95% CI of occupancy probability (ψ) estimates and naïve proportion of quarter-quadrangles where species were detected. Example: Naïve and corrected estimates of occupancy for Deer Mouse are the same while the corrected estimate of occupancy for Heather Vole is higher than the naïve proportion of quarter-quadrangles where the species was detected. The greatest difference between naïve and corrected estimates of occupancy is seen for those species where detection probability was lowest. See Tables 7-8 for additional data.

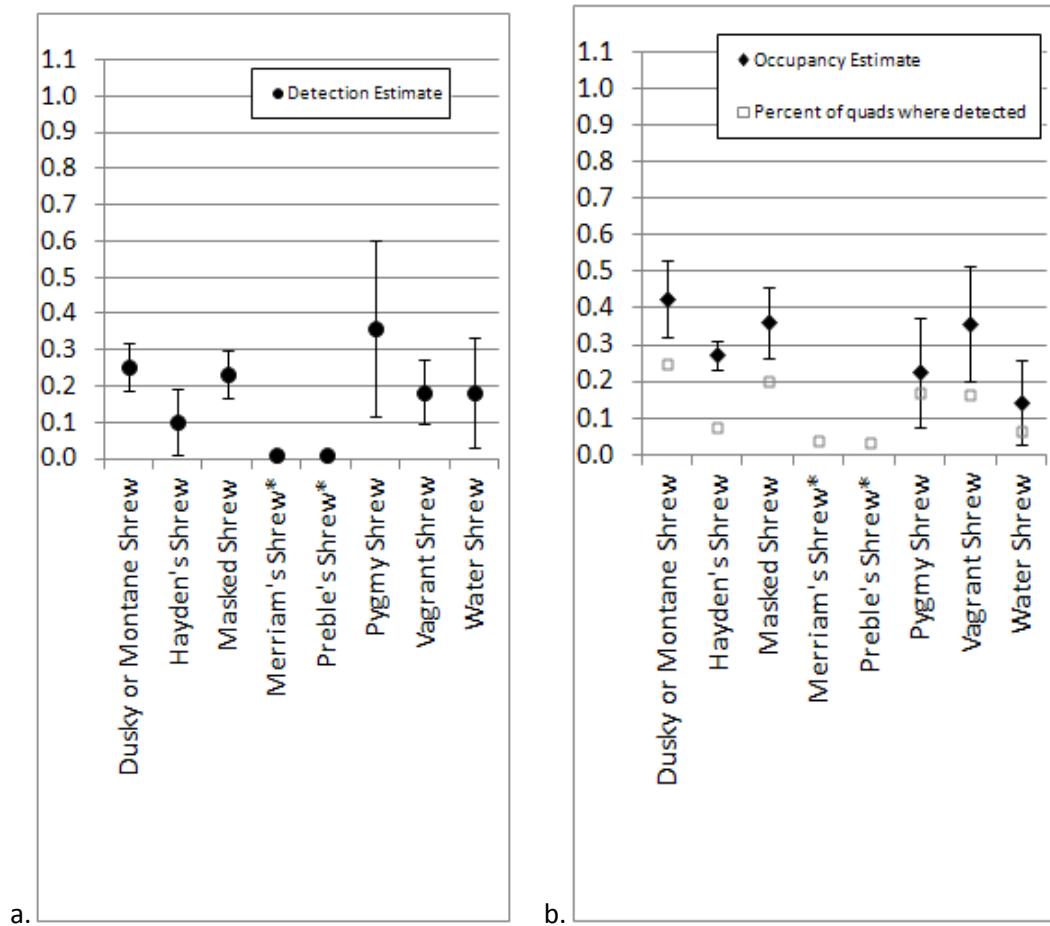


Detection and occupancy estimates from small mammal capture surveys for Soricidae.

Figure 13a. Point estimates and 95% CI of detection probability (p) estimates. Asterisks represent species where too few repeat detections precluded an appropriate estimate of detection and/or occupancy.

Figure 13b. Point estimates and 95% CI of occupancy probability (ψ) estimates and naïve proportion of quarter-quadrangles where species were detected.

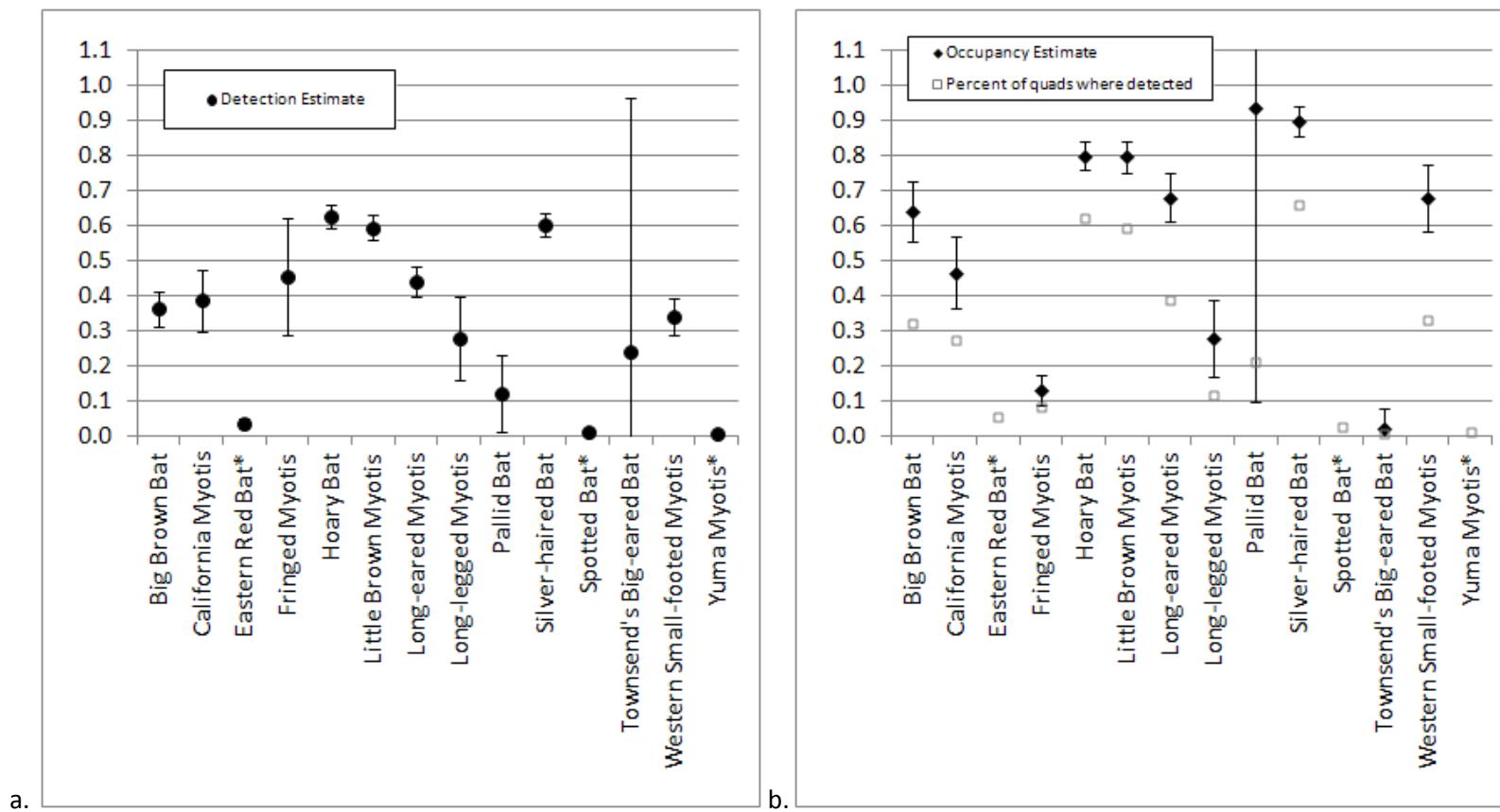
Example: Naïve and estimated occupancy for Pygmy Shrew are nearly the same while estimated occupancy for Vagrant Shrew is higher than naïve proportion of quarter-quadrangles where the species was detected. The greatest difference between naïve and estimated occupancy is seen for species with the lowest detection probabilities. See Tables 7-8 for additional data.



Detection and occupancy estimates from bat surveys for all bat species detected.

Figure 14a. Point estimates and 95% CI of detection probability (p) estimates. Asterisks represent species where too few repeat detections precluded an appropriate estimate of detection and/or occupancy.

Figure 14b. Point estimates and 95% CI of occupancy probability (ψ) estimates and naïve proportion of quarter-quadrangles where species was detected. Example: Naïve and estimated occupancy for Townsend's Big-eared Bat are the same, while estimated occupancy for Pallid Bat is much higher than the naïve proportion of quarter-quadrangles where the species was detected. The greatest difference between naïve and estimated occupancy is seen for those species with the lowest detection probabilities. See Tables 7-8 for additional data.

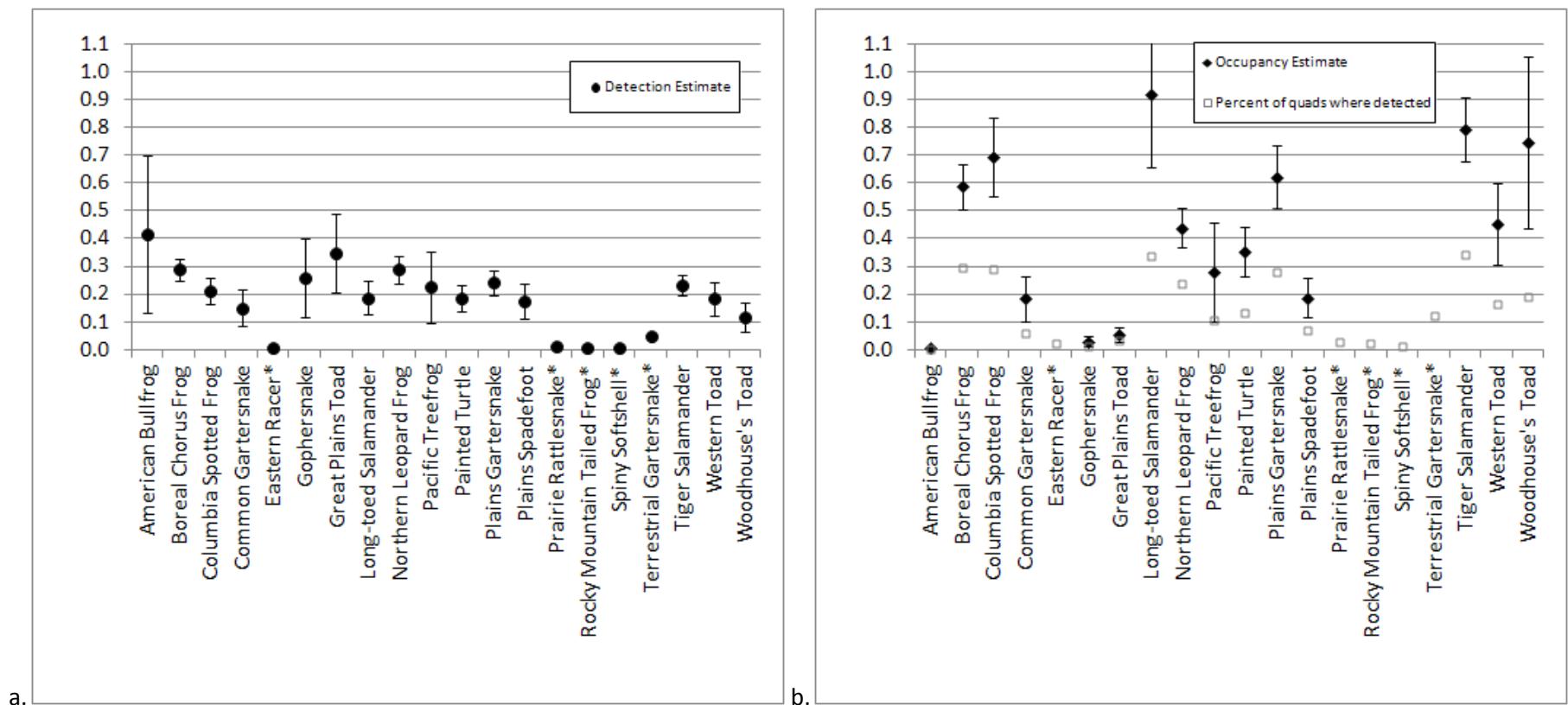


Detection and occupancy estimates from lentic site survey efforts for all amphibian and aquatic reptile species.

Figure 15a. Point estimates and 95% CI of detection probability (p) estimates. Asterisks represent species where too few repeat detections precluded an appropriate estimate of detection and/or occupancy.

Figure 15b. Point estimates and 95% CI of occupancy probability (ψ) estimates and naïve proportion of quarter-quadrangles where species was detected.

Example: Naïve and estimated occupancy for Great Plains Toad are the same while the estimated occupancy for the Long-toed Salamander is much higher than the naïve proportion of quarter-quadrangles where the species was detected. The greatest difference between naïve and estimated occupancy is seen for those species with the lowest detection probabilities. See Tables 7-8 for additional data.



Detection and occupancy estimates from reptile surveys for all reptiles detected.

Figure 16a. Point estimates and 95% CI of detection probability (p) estimates. Asterisks represent species where too few repeat detections precluded an appropriate estimate of detection and/or occupancy.

Figure 16b. Point estimates and 95% CI of occupancy probability (ψ) estimates and naïve proportion of quarter-quadrangles where species was detected.

Example: Naïve and estimated occupancy for Common Sagebrush Lizard were relatively close compared to the large difference between the naïve and estimated occupancy for Greater Short-horned Lizard. The greatest difference between naïve and estimated occupancy is seen for those species with the lowest detection probabilities. See Tables 7-8 for additional data.

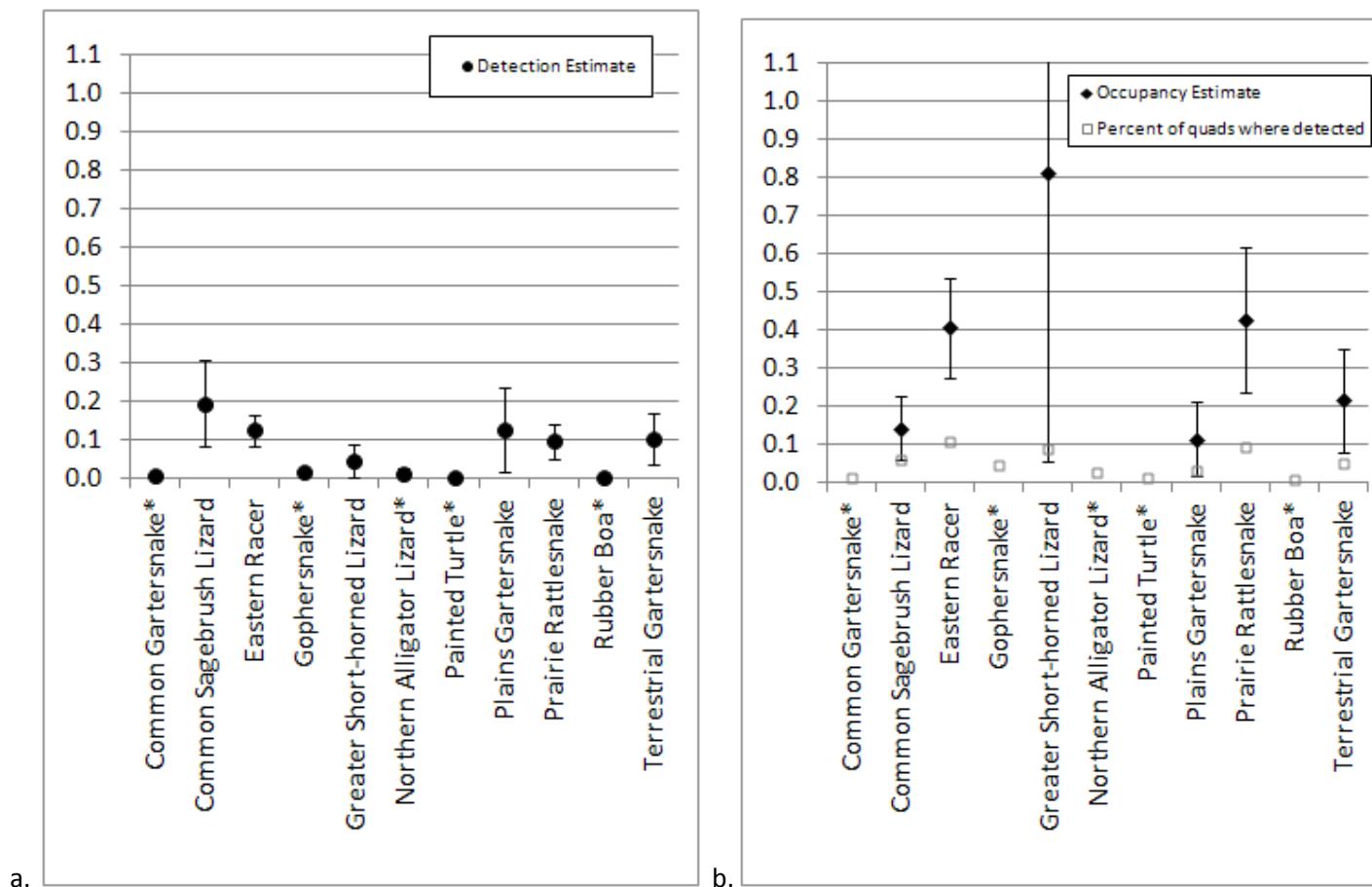


Figure 17a. Ratio of the proportion of quarter-quadrangles where a detection occurred (naïve detection rate) to the estimated occupancy rate for each species captured during small mammal surveys. A ratio of one indicates that the proportion of quarter-quadrangles where a detection occurred and the estimated occupancy is identical. A ratio less than one indicates that the occupancy estimate is higher than the proportion of quarter-quadrangles where a detection actually occurred. Many of the species with the lowest ratios (e.g., Short-tailed Weasel, Long-tailed Weasel, Bushy-tailed Woodrat, and Striped Skunk) were not targeted with survey methods that are most appropriate for these species (e.g., track plates or Tomahawk traps).

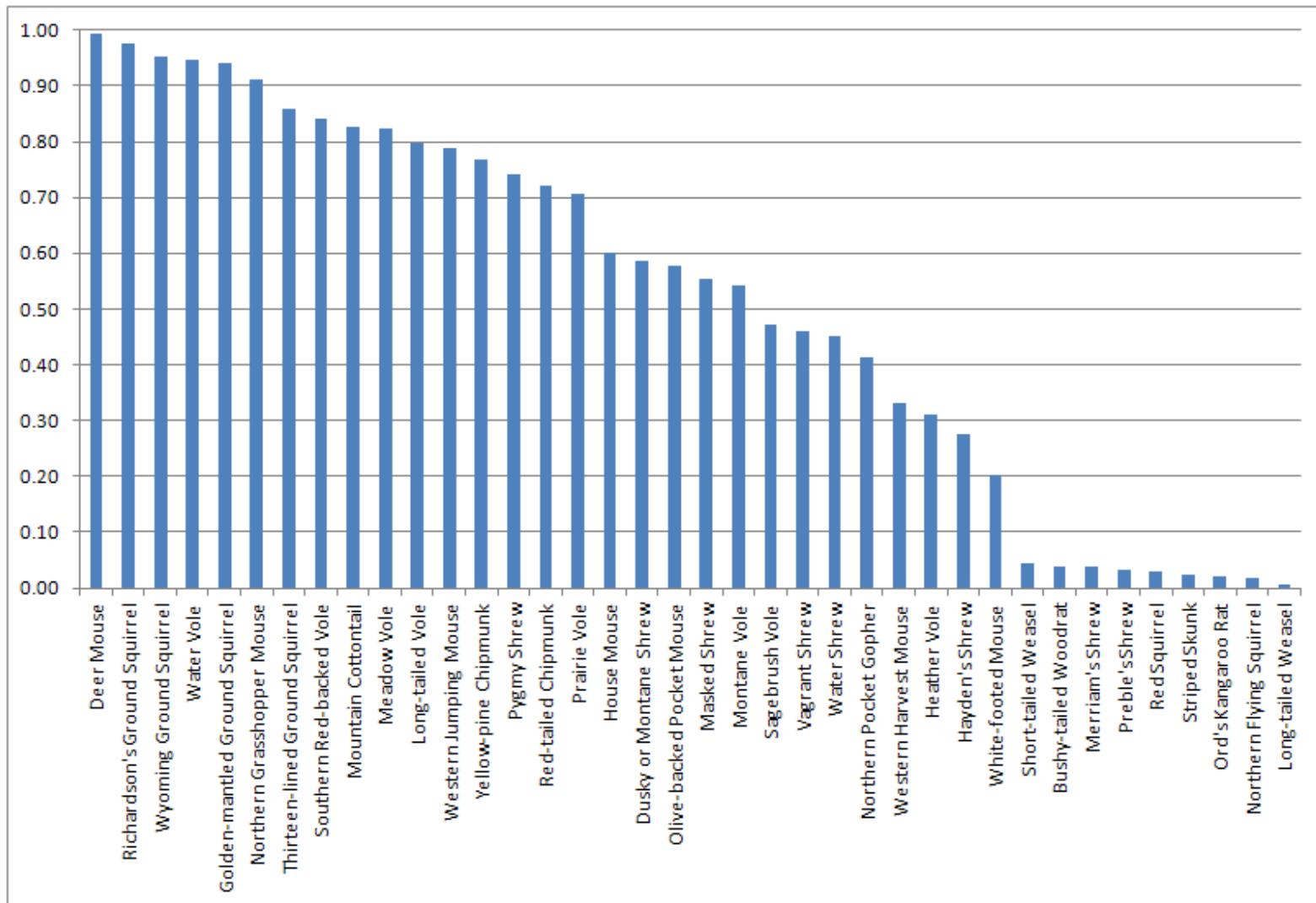


Figure 17b. Ratio of the proportion of quarter-quadrangles where a detection occurred (naïve detection rate) to the estimated occupancy rate for each species captured during bat acoustic surveys. A ratio of one indicates that the proportion of quarter-quadrangles where a detection occurred and the estimated occupancy is identical. A ratio less than one indicates that the occupancy estimate is higher than the proportion of quarter-quadrangles where a detection actually occurred.

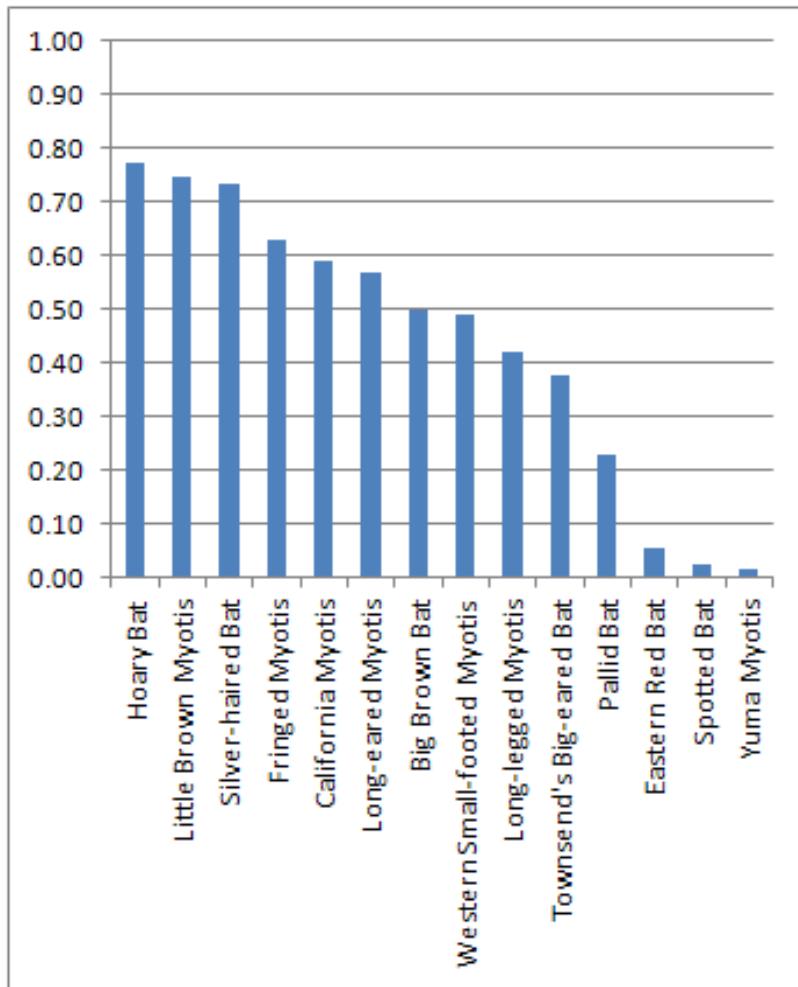
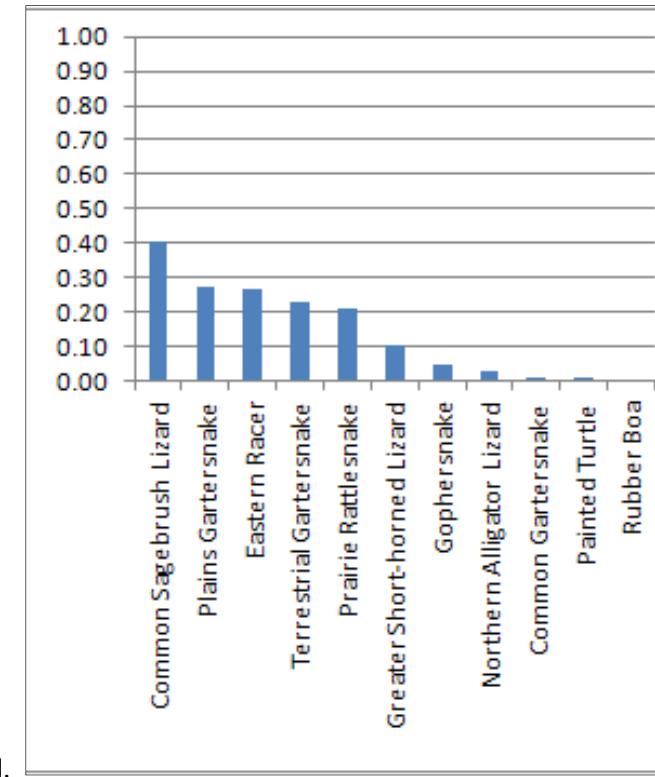
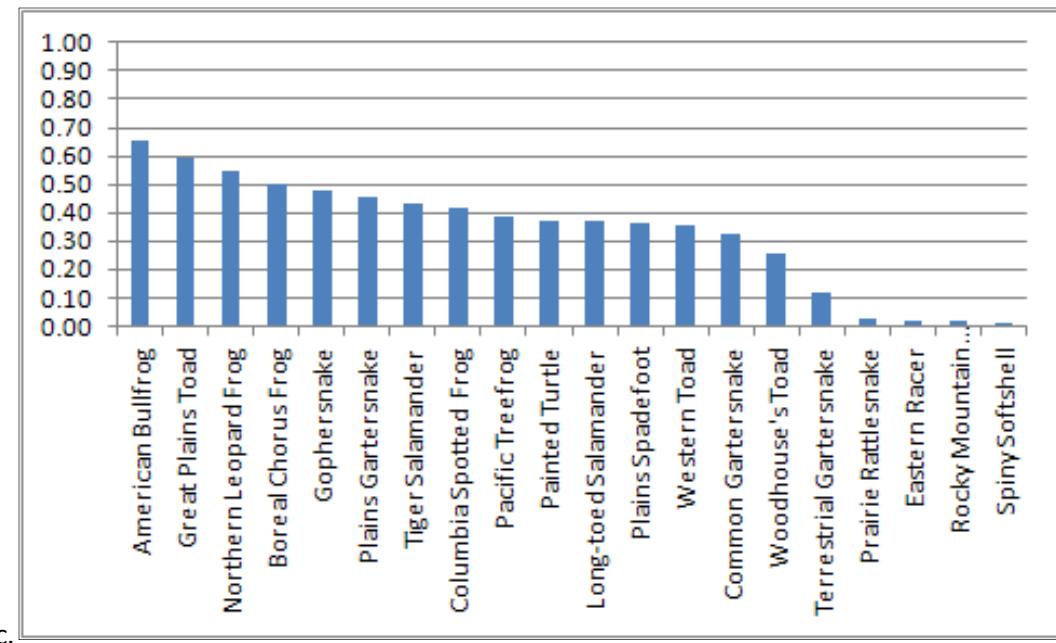


Figure 17c. Ratio of the proportion of quarter-quadrangles where a detection occurred (naïve detection rate) to the estimated occupancy rate for each species captured during amphibian and aquatic reptile lentic site surveys. A ratio of one indicates that the proportion of quarter-quadrangles where a detection occurred and the estimated occupancy is identical. A ratio less than one indicates that the occupancy estimate is higher than the proportion of quarter-quadrangles where a detection actually occurred.

Figure 17d. Ratio of the proportion of quarter-quadrangles where a detection occurred (naïve detection rate) to the estimated occupancy rate for each species captured during reptile surveys. A ratio of one indicates that the proportion of quarter-quadrangles where a detection occurred and the estimated occupancy is identical. A ratio less than one indicates that the occupancy estimate is higher than the proportion of quarter-quadrangles where a detection actually occurred.



Tables

Table 1. List of materials used for each survey type.

General Purpose Gear	Small Mammal Trap Line Surveys	Bat Acoustic Detector Surveys	Amphibian and Aquatic Reptile Lentic Site Surveys	Terrestrial Reptile Surveys
Digital Cameras	Sherman Traps	i-River H320 Zoom digital recorders	Aquarium nets	Potato rakes
Garmin 60 CSX GPS Units	Museum Special Traps	Aluminum bat poles	3 mm mesh dipnets	Retractable snake rakes
Identification kits and Field Guides	1-gallon buckets for Pitfall Traps	PVC housing	Tricaine	Snake grabber
File folders for storing quarter-quadrangle data sheets	Victor brand mouse and rat traps	I-river H320 Zoom wall chargers w/o adaptors	Formalin	Snake hook
Laptop computers	Large Tomahawk traps	I-river H320 Zoom car chargers	Kill jars and cottonballs	Turtle Traps
Data sheets and all-weather paper	Isoflurane, kill jars, and cottonballs	I-river H320 Zoom dock	Oragel (20% Benzocaine)	Formalin
Clipboards, legal pads, pencils, pens	Flagging	Post pounder	pH paper	Kill jars and cottonballs
Miscellaneous hand tools	Sweet feed	Headphones	Thermometer	Head lamps and flashlights
External Hard Drive for data storage	Irwin Chalk	Patch cords		
First aid kits	Ziplock/small plastic bags	Batteries - 9v and AA		
Safety masks and rubber gloves	Weed sprayers for decontaminating gear	Waterproof bat boxes		
BLM topo maps and Laminated quad maps		Petterson D240x bat detector		
Calipers				
Binoculars				
DC to AC power inverter				
Digital scales				
Magnifying glasses				
Rulers / tape measures				

*Only used in 2008.

Table 2. Data types collected for each fauna sampling procedure. Italics indicates that data was obtained via GIS analysis, whereas bold indicates data was collected in the field for all fauna groups. Variable types are indicated by a letter code, representing Q = quantitative, C = categorical, Y/N = yes or no type variable.

	LENTIC SURVEYS		MAMMAL TRAP LINE SURVEYS		BAT ACOUSTIC SURVEYS		TERRESTRIAL REPTILE SURVEYS
C	<i>Ecoregion</i>	C	<i>Ecoregion</i>	C	<i>Ecoregion</i>	C	<i>Ecoregion</i>
C	<i>Ownership</i>	C	<i>Ownership</i>	C	<i>Ownership</i>	C	<i>Ownership</i>
Q	<i>Elevation</i>	Q	<i>Elevation</i>	Q	<i>Elevation</i>	Q	<i>Elevation</i>
C	<i>ReGap Habitat Class</i>	C	<i>ReGap Habitat</i>	C	<i>ReGap Habitat</i>	C	<i>ReGap Habitat Class</i>
Q	TotalSurveyTime	Q	TotalSurveyTime	Q	TotalSurveyTime	Q	TotalSurveyTime
C	Observer	C	Observer	C	Observer	C	Observer
Y / N	SiteDry	Q	Trap Effort	C	Moon Phase	C	Percent Slope
C	LenticHabitatType	C	WeatherStart	C	WeatherStart	C	Dom Substrate
C	SiteOrigin	C	WeatherEnd	C	WeatherEnd	Y/N	PotentialHibernaculum
C	WaterColor	Q	TempStart	Q	TempStart	Q	AreaSearched
Q	WaterpH	Q	TempEnd	Q	TempEnd	C	PercentageLocationSurvey
C	WaterTurbidity			C	WindStart	C	SoilMoisture
C	WaterConnectedness			C	WindEnd	Q	SoilTemp
C	WaterPermanenence					C	WeatherStart
Q	MaxWaterDepth					C	WeatherEnd
Q	SiteLength					Q	TempStart
Q	SiteWidth					Q	TempEnd
C	% site <50cm deep					C	WindStart
Q	EmergentVegAreaMetersSquared					C	WindEnd
C	PercentSiteWithEmergentVeg					C	Aspect
C	PercentSiteWithLarvalActivity						
Q	RankSedges						
Q	RankGrasses						
Q	RankRushes						
Q	RankWaterLily						
Q	RankShrubs						
Q	RankOther		LENTIC SURVEYS (continued)				
C	PrimaryShallowsSubstrate	Y/N	FishSpawningHabitatPresent				
C	NorthShorelineCharacteristicsShallows	Q	InletWidth				
C	NorthShorelineCharacteristicsEmergen	Q	InletDepth				
Q	DistanceToForestEdgeMeters	C	InletSubstrate				
C	GrazingImpact	Q	OutletWidth				
Y/N	WaterDammedDiverted	Q	OutletDepth				
Y/N	TimberHarvestInArea	C	OutletSubstrate				
Y/N	MiningActivity	Q	Inclination				

Table 3. Summary of the types of surveys and the effort expended for each survey type during the period 2008 - 2010.

Survey Type	Total Number of Days Surveyed	Total Number of Unique Surveys	Total Number of Locations Surveyed	Total Number of Q-Quads surveyed	Average Survey Time (Minutes) with Standard Deviation	Average Area Searched (Square Meters) with Standard Deviation
Small Mammal Trap Line Surveys	161	1,182	423	137	851 +/- 115	NA
Bat Acoustic Surveys	181	1,465	1,418	271	751 +/- 161	NA
Amphibian and Aquatic Reptile Lentic Site Surveys	133	712	706	180	34 +/- 31	3,937 +/- 93,925
Terrestrial Reptile Surveys	146	504	501	168	45 +/- 46	21,419 +/- 85,170
Total	213	3,863	3,048	282		

Table 4. Summary of the number of observations identifiable and unidentifiable to species made for each type of survey during the period 2008 - 2010. Only bat calls with definitive call sequences were included as identifiable captures. Bat acoustic surveys containing probable call sequences with no corresponding definitive call sequence were counted as unidentifiable detections.

Survey Type	Total Number of Identifiable Detections	Total Number of Surveys With Identifiable Detections	Proportion of Surveys With Identifiable Detections	Total Number of Unidentifiable Detections	Total Number of Unique Species Detected
Small Mammal Trap Line Surveys	2,470	832	0.70	24	39
Bat Acoustic Detector Surveys	1,769	783	0.53	628	15
Lentic Site Surveys	1,372	436	0.61	27	20
Reptile Area Search Surveys	195	129	0.26	24	11
All Structured Surveys	5,806	2,180	0.56	703	84
Incidental Observations	5,912	2,634	NA	133	301
Total	11,718	4,814	NA	836	341

Table 5. Summary of sampling efforts and detections made by dominant surrounding habitat type during small mammal trap line surveys and bat acoustic detection surveys, 2008 - 2010.

Dominant Habitat Type	No. Small mammal locations surveyed	No. Small mammal species detected	No. Individual small mammals detected	No. Bat detector locations surveyed	No. Bat species detected	No. Individual bat passes detected
Forest and woodland	121	30	359	397	12	503
Polar and high montane	9	8	21	15	4	8
Semi desert	81	21	205	242	13	310
Shrubland and grassland	107	22	288	349	13	452
Sparse rock vegetation	22	10	52	66	7	98
Transitional Vegetation	12	12	43	42	7	31
Water	3	2	8	39	9	65
Woody Wetland	1	6	3	6	1	1
Developed	8	5	26	59	10	73
Agriculture	36	16	121	150	8	155
Introduced vegetation	18	11	53	59	7	66

Table 6. Summary of trapping effort and detections made by trap type during small mammal trap line surveys, 2008 - 2010.

Trap Type	Total number of traps set	Total number of captures	Percentage successful trap sets
Mouse Trap	10,249	444	4.3 %
Museum Special	9,417	619	6.6 %
Rat Trap	2,104	39	1.9 %
Pitfall	11,416	275	2.4 %
Sherman	10,473	428	4.1 %
Tomahawk (2008 only)	491	17	3.5 %
Track plate (2008 only)	282	4	1.4 %

Table 7. Statewide summary of survey and quarter-quadrangle naïve detections, detection probability (p) estimates, and occupancy probability (psi) estimates for all species captured during structured surveys for bats, amphibians, reptiles, and small mammals. Species with an asterisk represent those where the number of repeat detections was too low to estimate occupancy.

Survey type	Species	No. survey detections	Proportion of surveys where detected	No. quarter-quadrangles with detections	Proportion of quarter-quadrangles where detected	p	psi	p (se)	p lower 95% CI	p upper 95% CI	psi (se)	psi lower 95% CI	psi upper 95% CI
Bat Acoustic	Big Brown Bat	113	0.08	87	0.32	0.36	0.64	0.05	0.27	0.46	0.09	0.46	0.79
Bat Acoustic	California Myotis	36	0.02	28	0.13	0.35	0.22	0.09	0.23	0.53	0.06	0.13	0.35
Bat Acoustic	Eastern Red Bat	6	0.00	6	0.02	0.01	1.00	0.01	0.01	0.03	0.01	0.00	1.00
Bat Acoustic	Fringed Myotis	20	0.01	19	0.07	0.43	0.12	0.17	0.16	0.75	0.04	0.06	0.23
Bat Acoustic	Hoary Bat	235	0.16	168	0.62	0.63	0.80	0.03	0.56	0.69	0.04	0.71	0.87
Bat Acoustic	Little Brown Myotis	224	0.15	161	0.59	0.60	0.80	0.04	0.52	0.66	0.05	0.69	0.87
Bat Acoustic	Long-eared Myotis	148	0.10	105	0.39	0.44	0.68	0.04	0.36	0.53	0.07	0.53	0.80
Bat Acoustic	Long-legged Myotis	34	0.02	32	0.12	0.28	0.28	0.12	0.11	0.56	0.11	0.12	0.53
Bat Acoustic	Pallid Bat	7	0.00	6	0.02	0.12	0.12	0.11	0.02	0.50	0.11	0.02	0.52
Bat Acoustic	Silver-haired Bat	258	0.18	179	0.66	0.60	0.90	0.03	0.54	0.66	0.04	0.78	0.96
Bat Acoustic	Spotted Bat *	2	0.00	2	0.01	0.01	1.00	0.01	0.00	0.02	0.00	1.00	1.00
Bat Acoustic	Townsend's Big-eared Bat	2	0.00	2	0.01	0.20	0.02	0.76	0.00	1.00	0.08	0.00	0.96
Bat Acoustic	Western Small-footed Myotis	109	0.07	90	0.33	0.34	0.68	0.05	0.25	0.45	0.10	0.47	0.83
Bat Acoustic	Yuma Myotis *	2	0.01	2	0.01	0.01	1.00	0.00	0.00	0.02	0.28	0.00	1.00
Lentic Surveys	American Bullfrog	2	0.00	1	0.01	0.41	0.01	0.28	0.07	0.88	0.01	0.00	0.04
Lentic Surveys	Boreal Chorus Frog	96	0.13	62	0.34	0.29	0.43	0.04	0.22	0.37	0.06	0.32	0.55

Survey type	Species	No. survey detections	Proportion of surveys where detected	No. quarter-quadrangles with detections	Proportion of quarter-quadrangles where detected	p	psi	p (se)	p lower 95% CI	p upper 95% CI	psi (se)	psi lower 95% CI	psi upper 95% CI
Lentic Surveys	Columbia Spotted Frog	53	0.07	40	0.22	0.21	0.35	0.05	0.13	0.31	0.08	0.22	0.52
Lentic Surveys	Common Gartersnake	17	0.02	13	0.07	0.15	0.15	0.06	0.06	0.32	0.07	0.06	0.33
Lentic Surveys	Eastern Racer *	6	0.01	6	0.03	0.01	1.00	0.00	0.00	0.00	0.00	0.00	1.00
Lentic Surveys	Gophersnake	6	0.01	4	0.02	0.26	0.03	0.14	0.07	0.60	0.02	0.01	0.10
Lentic Surveys	Great Plains Toad	8	0.01	5	0.03	0.35	0.03	0.14	0.14	0.65	0.02	0.01	0.08
Lentic Surveys	Long-toed Salamander	28	0.04	22	0.12	0.19	0.21	0.06	0.09	0.33	0.07	0.11	0.39
Lentic Surveys	Northern Leopard Frog	67	0.09	50	0.28	0.29	0.34	0.05	0.20	0.39	0.06	0.24	0.46
Lentic Surveys	Pacific Treefrog	6	0.01	4	0.02	0.23	0.03	0.13	0.06	0.57	0.02	0.01	0.11
Lentic Surveys	Painted Turtle	45	0.06	34	0.05	0.18	0.32	0.05	0.11	0.29	0.08	0.19	0.51
Lentic Surveys	Plains Gartersnake	62	0.09	45	0.06	0.24	0.35	0.05	0.17	0.35	0.07	0.23	0.49
Lentic Surveys	Plains Spadefoot	20	0.03	14	0.08	0.18	0.14	0.06	0.08	0.33	0.05	0.06	0.28
Lentic Surveys	Prairie Rattlesnake *	7	0.00	7	0.01	0.01	1.00	0.00	0.00	0.02	0.00	0.00	1.00
Lentic Surveys	Rocky Mountain Tailed Frog *	1	0.00	1	0.01	0.01	1.00	0.01	0.00	0.01	0.07	0.00	1.00
Lentic Surveys	Spiny Softshell Turtle *	1	0.00	1	0.01	0.00	1.00	0.00	0.01	0.03	0.07	0.00	1.00
Lentic Surveys	Terrestrial Gartersnake	27	0.04	27	0.15	0.05	1.00	0.01	0.03	0.07	0.00	0.00	1.00
Lentic Surveys	Tiger Salamander	92	0.13	65	0.36	0.23	0.53	0.04	0.17	0.31	0.08	0.37	0.68
Lentic Surveys	Western Toad	26	0.04	19	0.11	0.18	0.19	0.06	0.09	0.32	0.06	0.09	0.34

Survey type	Species	No. survey detections	Proportion of surveys where detected	No. quarter-quadrangles with detections	Proportion of quarter-quadrangles where detected	p	psi	p (se)	p lower 95% CI	p upper 95% CI	psi (se)	psi lower 95% CI	psi upper 95% CI
Lentic Surveys	Woodhouse's Toad	29	0.04	25	0.14	0.12	0.35	0.05	0.05	0.26	0.15	0.13	0.65
Reptile Area Search	Common Gartersnake	3	0.01	3	0.01	0.01	1.00	0.00	0.00	0.01	0.01	1.00	1.00
Reptile Area Search	Common Sagebrush Lizard	9	0.02	7	0.04	0.19	0.07	0.11	0.05	0.49	0.04	0.02	0.19
Reptile Area Search	Eastern Racer	37	0.07	29	0.06	0.13	0.39	0.04	0.07	0.23	0.13	0.19	0.64
Reptile Area Search	Gophersnake	13	0.03	13	0.03	0.02	1.00	0.01	0.01	0.03	0.00	1.00	1.00
Reptile Area Search	Greater Short-horned Lizard	16	0.03	15	0.09	0.04	0.50	0.04	0.01	0.25	0.47	0.03	0.98
Reptile Area Search	Northern Alligator Lizard *	1	0.00	1	0.01	0.01	1.00	0.01	0.00	0.01	0.07	1.00	1.00
Reptile Area Search	Painted Turtle *	3	0.01	3	0.02	0.00	1.00	0.00	0.00	0.01	0.01	0.00	1.00
Reptile Area Search	Plains Gartersnake	6	0.01	5	0.03	0.13	0.11	0.11	0.02	0.51	0.10	0.02	0.47
Reptile Area Search	Prairie Rattlesnake	28	0.06	24	0.14	0.13	0.07	0.11	0.02	0.51	0.06	0.01	0.30
Reptile Area Search	Rubber Boa *	1	0.00	1	0.01	0.00	1.00	0.00	0.00	0.01	0.03	0.00	1.00
Reptile Area Search	Terrestrial Gartersnake	13	0.03	11	0.02	0.10	0.17	0.07	0.03	0.32	0.11	0.04	0.48
Small Mammal	Bushy-tailed Woodrat *	5	0.00	5	0.04	0.01	1.00	0.01	0.01	0.03	0.00	0.00	1.00
Small Mammal	Deer Mouse	343	0.29	124	0.91	0.88	0.93	0.02	0.85	0.91	0.02	0.87	0.97
Small Mammal	Dusky or Montane Shrew	36	0.03	27	0.20	0.24	0.36	0.06	0.14	0.39	0.09	0.20	0.55

Survey type	Species	No. survey detections	Proportion of surveys where detected	No. quarter-quadrangles with detections	Proportion of quarter-quadrangles where detected	p	psi	p (se)	p lower 95% CI	p upper 95% CI	psi (se)	psi lower 95% CI	psi upper 95% CI
Small Mammal	Golden-mantled Ground Squirrel	2	0.00	1	0.01	0.63	0.01	0.32	0.11	0.96	0.01	0.00	0.06
Small Mammal	Hayden's Shrew	7	0.01	6	0.04	0.10	0.16	0.09	0.02	0.45	0.15	0.02	0.62
Small Mammal	Heather Vole	6	0.01	5	.04	0.12	0.11	0.11	0.02	0.52	0.10	0.02	0.48
Small Mammal	House Mouse	11	0.01	7	0.05	0.26	0.09	0.11	0.11	0.51	0.04	0.03	0.21
Small Mammal	Least Chipmunk	6	0.01	4	0.03	0.29	0.06	0.16	0.08	0.64	0.03	0.02	0.17
Small Mammal	Long-tailed Vole	25	0.02	15	0.11	0.42	0.14	0.09	0.26	0.60	0.04	0.08	0.23
Small Mammal	Long-tailed Weasel *	1	0.00	1	0.01	0.00	1.00	0.00	0.00	0.02	0.00	1.00	1.00
Small Mammal	Masked Shrew	35	0.03	27	0.20	0.23	0.36	0.07	0.13	0.39	0.10	0.20	0.56
Small Mammal	Meadow Vole	92	0.08	53	0.39	0.45	0.48	0.05	0.36	0.54	0.06	0.37	0.59
Small Mammal	Merriam's Shrew *	3	0.00	3	0.02	0.01	1.00	0.01	0.00	0.04	0.00	0.00	1.00
Small Mammal	Montane Vole	38	0.03	29	0.21	0.23	0.40	0.06	0.13	0.37	0.10	0.22	0.61
Small Mammal	Mountain Cottontail	2	0.00	2	0.02	0.45	0.02	0.18	0.16	0.77	0.01	0.00	0.07
Small Mammal	Northern Flying Squirrel *	1	0.00	1	0.01	0.01	1.00	0.01	0.00	0.02	0.00	1.00	1.00
Small Mammal	Northern Grasshopper Mouse	14	0.01	7	0.05	0.56	0.07	0.12	0.33	0.77	0.02	0.03	0.12
Small Mammal	Northern Pocket Gopher	6	0.01	5	0.04	0.16	0.09	0.14	0.02	0.59	0.07	0.02	0.37
Small Mammal	Olive-backed Pocket Mouse	16	0.01	11	0.08	0.25	0.14	0.09	0.12	0.47	0.06	0.06	0.28
Small Mammal	Ord's Kangaroo Rat *	1	0.00	1	0.01	0.01	1.00	0.01	0.00	0.02	0.06	0.00	1.00

Survey type	Species	No. survey detections	Proportion of surveys where detected	No. quarter-quadrangles with detections	Proportion of quarter-quadrangles where detected	p	psi	p (se)	p lower 95% CI	p upper 95% CI	psi (se)	psi lower 95% CI	psi upper 95% CI
Small Mammal	Prairie Vole	12	0.01	7	0.05	0.34	0.07	0.11	0.16	0.58	0.03	0.03	0.16
Small Mammal	Preble's Shrew	4	0.00	4	0.03	0.01	1.00	0.01	0.00	0.03	0.00	0.00	1.00
Small Mammal	Pygmy Shrew	4	0.00	3	0.03	0.28	0.04	0.21	0.05	0.76	0.03	0.01	0.15
Small Mammal	Red Squirrel *	3	0.00	3	0.02	0.01	1.00	0.01	0.00	0.03	0.00	0.00	1.00
Small Mammal	Red-tailed Chipmunk	11	0.01	8	0.06	0.29	0.09	0.13	0.11	0.57	0.04	0.04	0.21
Small Mammal	Richardson's Ground Squirrel	14	0.01	6	0.01	0.72	0.05	0.11	0.47	0.88	0.02	0.02	0.10
Small Mammal	Sagebrush Vole	5	0.00	4	0.03	0.19	0.06	0.16	0.03	0.64	0.05	0.01	0.28
Small Mammal	Short-tailed Weasel	3	0.00	3	0.02	0.01	1.00	0.01	0.00	0.02	0.01	1.00	1.00
Small Mammal	Southern Red-backed Vole	47	0.04	27	0.20	0.48	0.24	0.07	0.35	0.61	0.04	0.16	0.33
Small Mammal	Striped Skunk *	3	0.00	3	0.02	0.01	1.00	0.00	0.00	0.02	0.01	0.00	1.00
Small Mammal	Thirteen-lined Ground Squirrel	6	0.01	3	0.02	0.48	0.03	0.18	0.19	0.79	0.02	0.01	0.08
Small Mammal	Vagrant Shrew	20	0.02	17	0.12	0.16	0.30	0.08	0.06	0.38	0.14	0.11	0.61
Small Mammal	Water Shrew	6	0.01	5	0.02	0.16	0.09	0.14	0.03	0.59	0.08	0.02	0.37
Small Mammal	Water Vole	4	0.00	2	0.02	0.63	0.02	0.22	0.21	0.92	0.01	0.00	0.06
Small Mammal	Western Harvest Mouse	5	0.02	4	0.03	0.12	0.09	0.11	0.02	0.52	0.08	0.01	0.42
Small Mammal	Western Jumping Mouse	36	0.09	22	0.16	0.40	0.21	0.07	0.27	0.55	0.05	0.13	0.31
Small Mammal	White-footed Mouse	10	0.04	9	0.07	0.07	0.33	0.07	0.01	0.36	0.30	0.03	0.88

Survey type	Species	No. survey detections	Proportion of surveys where detected	No. quarter-quadrangles with detections	Proportion of quarter-quadrangles where detected	p	psi	p (se)	p lower 95% CI	p upper 95% CI	psi (se)	psi lower 95% CI	psi upper 95% CI
Small Mammal	Wyoming Ground Squirrel	6	0.12	3	0.02	0.63	0.02	0.18	0.28	0.89	0.01	0.01	0.07
Small Mammal	Yellow-pine Chipmunk	14	0.07	9	0.07	0.40	0.09	0.12	0.20	0.64	0.03	0.04	0.17

Table 8. Range-limited summary of survey and quarter-quadrangle naïve detections, detection probability (p) estimates, and occupancy probability (psi) estimates for all species captured during structured surveys for bats, amphibians, reptiles, and small mammals. Species with an asterisk represent those where the number of repeat detections was too low to estimate occupancy.

Survey type	Species	No. survey detections	Proportion of surveys where detected	No. quarter-quadrangles with detections	Proportion of quarter-quadrangles where detected	p	psi	p (se)	p lower 95% CI	p upper 95% CI	psi (se)	psi lower 95% CI	psi upper 95% CI
Bat Acoustic	Big Brown Bat	113	0.24	87	0.32	0.36	0.64	0.05	0.27	0.46	0.09	0.46	0.79
Bat Acoustic	California Myotis	36	0.17	28	0.27	0.39	0.47	0.09	0.23	0.57	0.10	0.28	0.66
Bat Acoustic	Eastern Red Bat	6	0.04	6	0.05	0.04	1.00	0.01	0.02	0.08	0.00	0.00	1.00
Bat Acoustic	Fringed Myotis	20	0.05	19	0.08	0.46	0.13	0.17	0.18	0.76	0.04	0.07	0.24
Bat Acoustic	Hoary Bat	235	0.49	168	0.62	0.63	0.80	0.03	0.56	0.69	0.04	0.71	0.87
Bat Acoustic	Little Brown Myotis	224	0.47	161	0.59	0.60	0.80	0.04	0.52	0.66	0.05	0.69	0.87
Bat Acoustic	Long-eared Myotis	148	0.31	105	0.39	0.44	0.68	0.04	0.36	0.53	0.07	0.53	0.80
Bat Acoustic	Long-legged Myotis	34	0.07	32	0.12	0.28	0.28	0.12	0.11	0.56	0.11	0.12	0.53
Bat Acoustic	Pallid Bat	7	0.11	6	0.21	0.12	0.93	0.11	0.02	0.51	0.83	0.00	1.00
Bat Acoustic	Silver-haired Bat	258	0.54	179	0.66	0.60	0.90	0.03	0.54	0.66	0.04	0.78	0.96
Bat Acoustic	Spotted Bat *	2	0.01	2	0.03	0.01	1.00	0.01	0.00	0.04	0.00	1.00	1.00
Bat Acoustic	Townsend's Big-eared Bat	2	0.00	2	0.01	0.24	0.02	0.72	0.00	1.00	0.06	0.00	0.94
Bat Acoustic	Western Small-footed Myotis	109	0.23	90	0.33	0.34	0.68	0.05	0.25	0.45	0.10	0.47	0.83
Bat Acoustic	Yuma Myotis *	2	0.01	2	0.01	0.01	1.00	0.00	0.00	0.03	0.03	0.00	1.00
Lentic Surveys	American Bullfrog	2	0.00	1	0.00	0.41	0.01	0.28	0.07	0.88	0.01	0.00	0.04
Lentic Surveys	Boreal Chorus Frog	96	0.18	62	0.29	0.29	0.59	0.04	0.22	0.37	0.08	0.43	0.73
Lentic Surveys	Columbia Spotted Frog	53	0.15	40	0.29	0.21	0.69	0.05	0.13	0.32	0.14	0.38	0.89
Lentic Surveys	Common Gartersnake	17	0.03	13	0.06	0.15	0.18	0.06	0.06	0.32	0.08	0.07	0.40
Lentic Surveys	Eastern Racer *	6	0.01	6	0.02	0.01	1.00	0.00	0.00	0.02	0.00	0.00	1.00
Lentic Surveys	Gophersnake	6	0.01	4	0.01	0.26	0.03	0.14	0.07	0.60	0.02	0.01	0.10
Lentic Surveys	Great Plains Toad	8	0.02	5	0.03	0.35	0.05	0.14	0.13	0.65	0.03	0.02	0.14
Lentic Surveys	Long-toed Salamander	28	0.17	22	0.34	0.19	0.92	0.06	0.09	0.33	0.26	0.01	1.00

Survey type	Species	No. survey detections	Proportion of surveys where detected	No. quarter-quadrangles with detections	Proportion of quarter-quadrangles where detected	p	psi	p (se)	p lower 95% CI	p upper 95% CI	psi (se)	psi lower 95% CI	psi upper 95% CI
Lentic Surveys	Northern Leopard Frog	67	0.12	50	0.24	0.29	0.44	0.05	0.20	0.40	0.07	0.31	0.58
Lentic Surveys	Pacific Treefrog	6	0.07	4	0.11	0.22	0.28	0.13	0.06	0.56	0.18	0.06	0.69
Lentic Surveys	Painted Turtle	45	0.07	34	0.13	0.18	0.35	0.05	0.11	0.29	0.09	0.20	0.54
Lentic Surveys	Plains Gartersnake	62	0.15	45	0.28	0.24	0.62	0.05	0.16	0.34	0.11	0.39	0.81
Lentic Surveys	Plains Spadefoot	20	0.04	14	0.07	0.18	0.19	0.06	0.08	0.33	0.07	0.08	0.36
Lentic Surveys	Prairie Rattlesnake *	7	0.01	7	0.03	0.01	1.00	0.00	0.00	0.02	0.00	1.00	1.00
Lentic Surveys	Rocky Mountain Tailed Frog *	1	0.01	1	0.02	0.01	1.00	0.01	0.00	0.05	0.00	1.00	1.00
Lentic Surveys	Spiny Softshell Turtle *	1	0.00	1	0.01	0.00	1.00	0.00	0.00	0.03	0.00	1.00	1.00
Lentic Surveys	Terrestrial Gartersnake	27	0.05	27	0.12	0.05	1.00	0.01	0.03	0.07	0.00	0.00	1.00
Lentic Surveys	Tiger Salamander	92	0.19	65	0.34	0.23	0.79	0.04	0.17	0.31	0.12	0.49	0.92
Lentic Surveys	Western Toad	26	0.09	19	0.16	0.18	0.45	0.06	0.09	0.32	0.15	0.21	0.72
Lentic Surveys	Woodhouse's Toad	29	0.09	25	0.19	0.12	0.75	0.05	0.05	0.26	0.31	0.11	0.99
Reptile Area Search	Common Gartersnake	3	0.01	3	0.01	0.01	1.00	0.00	0.00	0.02	0.01	0.00	1.00
Reptile Area Search	Common Sagebrush Lizard	9	0.03	7	0.06	0.19	0.14	0.11	0.06	0.49	0.08	0.04	0.38
Reptile Area Search	Eastern Racer	37	0.05	29	0.11	0.13	0.41	0.04	0.07	0.23	0.13	0.19	0.67
Reptile Area Search	Gophersnake	13	0.02	13	0.05	0.02	1.00	0.01	0.01	0.03	0.00	1.00	1.00
Reptile Area Search	Greater Short-horned Lizard	16	0.04	15	0.09	0.04	0.81	0.04	0.01	0.25	0.76	0.00	1.00
Reptile Area Search	Northern Alligator Lizard *	1	0.01	1	0.03	0.01	1.00	0.01	0.00	0.08	0.00	1.00	1.00
Reptile Area Search	Painted Turtle *	3	0.00	3	0.01	0.00	1.00	0.00	0.00	0.01	0.01	0.00	1.00
Reptile Area Search	Plains Gartersnake	6	0.01	5	0.03	0.13	0.11	0.11	0.02	0.51	0.10	0.02	0.47
Reptile Area Search	Prairie Rattlesnake	28	0.04	24	0.09	0.10	0.43	0.04	0.04	0.22	0.19	0.14	0.77

Survey type	Species	No. survey detections	Proportion of surveys where detected	No. quarter-quadrangles with detections	Proportion of quarter-quadrangles where detected	p	psi	p (se)	p lower 95% CI	p upper 95% CI	psi (se)	psi lower 95% CI	psi upper 95% CI
Reptile Area Search	Rubber Boa *	1	0.00	1	0.01	0.00	1.00	0.00	0.00	0.02	0.03	0.00	1.00
Reptile Area Search	Terrestrial Gartersnake	13	0.02	11	0.05	0.10	0.21	0.07	0.03	0.32	0.14	0.05	0.57
Small Mammal	Bushy-tailed Woodrat *	5	0.01	5	0.04	0.01	1.00	0.01	0.01	0.03	0.00	0.00	1.00
Small Mammal	Deer Mouse	343	0.83	124	0.93	0.88	0.93	0.02	0.85	0.91	0.02	0.87	0.97
Small Mammal	Dusky or Montane Shrew	36	0.11	27	0.25	0.25	0.43	0.07	0.14	0.40	0.11	0.24	0.64
Small Mammal	Golden-mantled Ground Squirrel	2	0.01	1	0.01	0.63	0.01	0.32	0.11	0.96	0.02	0.00	0.10
Small Mammal	Hayden's Shrew	7	0.03	6	0.08	0.10	0.27	0.09	0.01	0.45	0.04	0.03	0.81
Small Mammal	Heather Vole	6	0.03	5	0.07	0.12	0.23	0.11	0.02	0.51	0.21	0.03	0.75
Small Mammal	House Mouse	11	0.03	7	0.05	0.26	0.09	0.11	0.11	0.51	0.04	0.03	0.21
Small Mammal	Long-tailed Vole	25	0.06	15	0.12	0.42	0.15	0.09	0.26	0.59	0.04	0.09	0.24
Small Mammal	Long-tailed Weasel *	1	0.00	1	0.01	0.00	1.00	0.00	0.00	0.02	0.00	1.00	1.00
Small Mammal	Masked Shrew	35	0.08	27	0.20	0.23	0.36	0.07	0.13	0.39	0.10	0.20	0.56
Small Mammal	Meadow Vole	92	0.22	53	0.40	0.45	0.48	0.05	0.36	0.54	0.06	0.37	0.59
Small Mammal	Merriam's Shrew *	3	0.01	3	0.04	0.01	1.00	0.01	0.00	0.04	0.00	0.00	1.00
Small Mammal	Montane Vole	38	0.12	29	0.28	0.23	0.51	0.06	0.13	0.37	0.13	0.27	0.74
Small Mammal	Mountain Cottontail	2	0.00	2	0.01	0.45	0.02	0.18	0.16	0.77	0.01	0.00	0.07
Small Mammal	Northern Flying Squirrel *	1	0.01	1	0.02	0.01	1.00	0.01	0.00	0.04	0.00	1.00	1.00
Small Mammal	Northern Grasshopper Mouse	14	0.04	7	0.07	0.56	0.07	0.12	0.33	0.77	0.03	0.04	0.15
Small Mammal	Northern Pocket Gopher	6	0.01	5	0.04	0.16	0.09	0.14	0.02	0.59	0.07	0.02	0.37
Small Mammal	Olive-backed Pocket Mouse	16	0.07	11	0.15	0.25	0.26	0.09	0.12	0.47	0.10	0.11	0.49
Small Mammal	Ord's Kangaroo Rat *	1	0.01	1	0.02	0.01	1.00	0.01	0.00	0.04	0.00	1.00	1.00
Small Mammal	Prairie Vole	12	0.04	7	0.08	0.34	0.11	0.11	0.16	0.58	0.05	0.05	0.24

Survey type	Species	No. survey detections	Proportion of surveys where detected	No. quarter-quadrangles with detections	Proportion of quarter-quadrangles where detected	p	psi	p (se)	p lower 95% CI	p upper 95% CI	psi (se)	psi lower 95% CI	psi upper 95% CI
Small Mammal	Preble's Shrew	4	0.01	4	0.03	0.01	1.00	0.01	0.00	0.03	0.00	0.00	1.00
Small Mammal	Pygmy Shrew	4	0.07	3	0.17	0.36	0.22	0.24	0.07	0.82	0.15	0.05	0.61
Small Mammal	Red Squirrel *	3	0.01	3	0.03	0.01	1.00	0.01	0.00	0.03	0.00	0.00	1.00
Small Mammal	Red-tailed Chipmunk	11	0.11	8	0.24	0.34	0.33	0.14	0.14	0.63	0.13	0.13	0.60
Small Mammal	Richardson's Ground Squirrel	14	0.06	6	0.08	0.72	0.08	0.11	0.47	0.88	0.03	0.04	0.17
Small Mammal	Sagebrush Vole	5	0.01	4	0.04	0.19	0.08	0.16	0.03	0.64	0.06	0.01	0.32
Small Mammal	Short-tailed Weasel	3	0.01	3	0.04	0.01	1.00	0.01	0.00	0.04	0.00	1.00	1.00
Small Mammal	Southern Red-backed Vole	47	0.21	27	0.36	0.48	0.43	0.07	0.35	0.61	0.07	0.30	0.58
Small Mammal	Striped Skunk *	3	0.01	3	0.02	0.01	1.00	0.00	0.00	0.02	0.01	0.00	1.00
Small Mammal	Thirteen-lined Ground Squirrel	6	0.03	3	0.04	0.48	0.05	0.18	0.19	0.79	0.03	0.01	0.14
Small Mammal	Vagrant Shrew	20	0.06	17	0.17	0.18	0.36	0.09	0.07	0.41	0.16	0.13	0.68
Small Mammal	Water Shrew	6	0.03	5	0.06	0.18	0.14	0.15	0.03	0.63	0.12	0.03	0.51
Small Mammal	Water Vole	4	0.02	2	0.04	0.63	0.04	0.22	0.21	0.92	0.03	0.01	0.14
Small Mammal	Western Harvest Mouse	5	0.02	4	0.05	0.12	0.16	0.11	0.02	0.52	0.15	0.02	0.62
Small Mammal	Western Jumping Mouse	36	0.09	22	0.18	0.40	0.23	0.07	0.27	0.55	0.05	0.14	0.33
Small Mammal	White-footed Mouse	10	0.04	9	0.11	0.07	0.56	0.07	0.01	0.36	0.52	0.02	0.99
Small Mammal	Wyoming Ground Squirrel	6	0.12	3	0.19	0.64	0.20	0.18	0.28	0.89	0.10	0.06	0.47
Small Mammal	Yellow-pine Chipmunk	14	0.07	9	0.13	0.39	0.17	0.12	0.19	0.63	0.06	0.08	0.32